

InP MMIC Chip Set for Power Sources Covering 80-170 GHz

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We will present a Monolithic Millimeter-wave Integrated Circuit (MMIC) chip set which provides high output-power sources for driving diode frequency multipliers into the terahertz range. The chip set was fabricated at HRL Laboratories using a 0.1- μm gate-length InAlAs/InGaAs/InP high electron mobility transistor (HEMT) process, and features transistors with an f_{max} above 600 GHz. The HRL InP HEMT process has already demonstrated amplifiers in the 60-200 GHz range[1]. In this paper, these high frequency HEMTs form the basis for power sources up to 170 GHz.

A number of state-of-the-art InP HEMT MMICs will be presented. These include voltage-controlled and fixed-tuned oscillators, power amplifiers, and an active doubler. We will first discuss an 80 GHz voltage-controlled oscillator with 5 GHz of tunability and at least 17 mW of output power, as well as a 120 GHz oscillator providing 7 mW of output power. In addition, we will present results of a power amplifier which covers the full WR10 waveguide band (75-110 GHz), and provides 40-50 mW of output power. Furthermore, we will present an active doubler at 164 GHz providing 8% bandwidth, 3 mW of output power, and an unprecedented 2 dB of conversion loss for an InP HEMT MMIC at this frequency. Finally, we will demonstrate a power amplifier to cover 140-170 GHz with 15-25 mW of output power and 8 dB gain.

These components can form a power source in the 155-165 GHz range by cascading the 80 GHz oscillator, W-band power amplifier, 164 GHz active doubler and final 140-170 GHz power amplifier for a stable, compact local oscillator subsystem, which could be used for atmospheric science or astrophysics radiometers.

[1] C. Pobanz, M. Matloubian, V. Radisic, G. Raghavan, M. Case, M. Micovic, M. Hu, C. Nguyen, S. Weinreb, and L. Samoska, "High Performance MMICs with Submillimeter Wave InP-based HEMTs," in *InP & Related Materials, 2000 Conference Proceedings*, pp 67-70.

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